

# **EXHIBIT G**

**EXPERT REPORT OF JAMES MILLETTE, PHD (MVA) DATED 10/25/06**

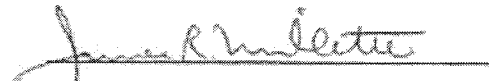
Report of Results: MVA6504

Asbestos Fibers Released  
from Monokote

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25 October 2006



## Report of Results -- MVA Project No. 6504

### Asbestos Fibers Released from Monokote

#### INTRODUCTION

In 1990, MVA Scientific Consultants was asked to consider the question of whether or not asbestos fibers were encased in the gypsum binder of a fireproofing material that was composed of vermiculite, chrysotile and gypsum (WRG Monokote). Under a magnifying glass (5x), asbestos fibers may appear to be completely encased in a binder and therefore, may not be considered to be releasable into the environment as free asbestos fibers. The term used then to describe this hypothesized condition of asbestos encased in binder was that the fibers were like "corn-dogs": an asbestos fiber in the center entirely coated with gypsum binder. At that time we performed some tests and published two papers on the subject. In a paper entitled "A Close Examination of Asbestos-Containing Debris"<sup>1</sup> we found that while the gypsum binder particles are intermixed with the chrysotile fibers, individual chrysotile asbestos fibers are free of the binder material. The conclusion was illustrated in this paper with a microscope image of a chrysotile bundle protruding from the surface of a piece of Monokote debris. At the low magnification of approximately 100 times, the bundle appears to be completely covered by binder material. However, at a higher magnification of approximately 1,400x it is clear that individual chrysotile asbestos fibers are free of the binder material. In addition, when the Monokote debris piece was crushed and the resulting particles analyzed by scanning electron microscopy with an x-ray elemental analysis system (SEM-EDS), many uncoated chrysotile fibers were observed among the vermiculite and gypsum particles. In another published article entitled "Stepping on Asbestos Debris"<sup>2</sup> particles were collected and analyzed by SEM-EDS after stepping on a piece of fireproofing composed of chrysotile asbestos, vermiculite and gypsum (Monokote). The results showed that chrysotile fibers were present and free of gypsum binder material. An x-ray analysis procedure called area dot mapping was used to show that a bundle of chrysotile asbestos fibers was not coated or encased with gypsum binder material.

Recently (during the period October 20 – October 24, 2006) we performed another test of the hypothesis that chrysotile asbestos fibers released from Monokote fireproofing are in the form of "corn-dogs". In this test Monokote debris particles greater than 1 mm in diameter were spread on the floor of a test chamber room and disturbed by walking and sweeping. A personal air sample was collected on the individual disturbing the debris and analyzed by a standard transmission electron microscopy (TEM) procedure.

#### METHODS AND EQUIPMENT

The fiber release testing was done in a containment chamber that was approximately

11 feet long, 9 1/2 feet wide and 9 foot high. The person in the chamber wore protective clothing and a respirator during the activity testing. A HEPA filtration system was running during the activity.

The released particles were collected with standard air filter cassettes using personal pumps. The filters were analyzed for fibers using transmission electron microscopy (NIOSH 7402)<sup>3</sup>. The TEM analyses were performed with a Philips 420 TEM equipped with an Oxford x-ray analysis system. Images and spectra of the particles found during the NIOSH 7402 analysis were recorded. In addition to the images of fibers counted under the NIOSH 7402 protocol, other images were also collected that provided information about the association of the gypsum binder with asbestos fibers.

### **SPECIFIC STUDY ACTIVITIES**

Prior to fiber release testing, the containment chamber was cleaned. A sample of the air in the room was collected for 1 hour at 5 liters per minute before activities commenced.

Two hundred and five grams of Monokote fireproofing debris (particles greater than 1 mm in diameter) that had been collected from a building in Hawaii were spread by hand on a concrete floor of the chamber in an area of approximately 3 feet by 3 feet. The debris was walked on with sneakers and swept-up with a nylon broom. The sweepings were collected in a dustpan and poured into an asbestos waste bag. The activity ran for 16 minutes. Two personal samplers were attached to the hood of the worker (in the breathing zone). The sample information is shown in Table 1. One personal sample had to be voided because the pump failed.

### **RESULTS**

Analysis of the air samples collected while the Monokote fireproofing was disturbed showed that uncoated asbestos fibers were released into the air (Figures 1 - 9).

Sample R1605 collected of the air in the chamber before the testing showed no asbestos detected by TEM analysis. The blank sample R1608 also showed no asbestos by TEM analysis.

### **CONCLUSIONS**

Based on the studies of asbestos fibers in-situ in Monokote fireproofing, asbestos fibers released as dust from crushing Monokote, and asbestos fibers released into the air from disturbing Monokote debris, chrysotile asbestos fibers associated with Monokote fireproofing are not encased in gypsum as in the condition known as a "corn-dog."

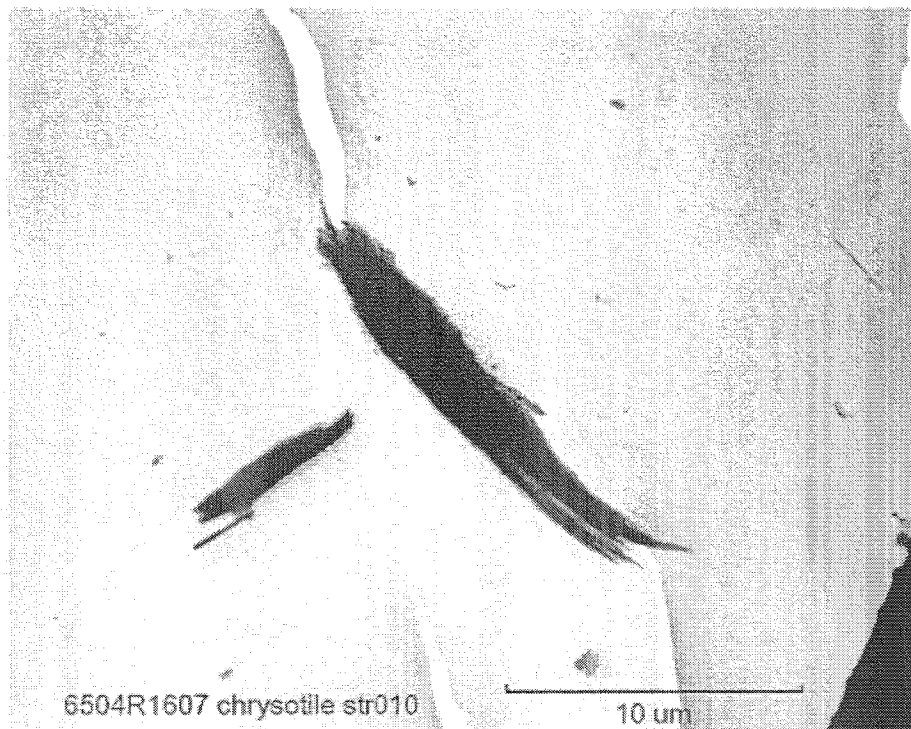
**REFERENCES**

1. Millette, J. R., Ewing, W., Brown, R. S., "A Close Examination of Asbestos-Containing Debris", NAC Journal 8 (3); 38-40, 1990.
2. Millette, J. R., Ewing, W., Brown, R. S., "Stepping on Asbestos Debris", Microscope, 38:321-326, 1990.
3. National Institute of Occupational Safety and Health, NIOSH 7402, "Asbestos Fibers by Transmission Electron Microscopy (TEM)" - Method 7402 - NIOSH Manual of Analytical Methods, 4th Ed., U.S. Department of HHS, NIOSH Publ. 94-126, 1994.

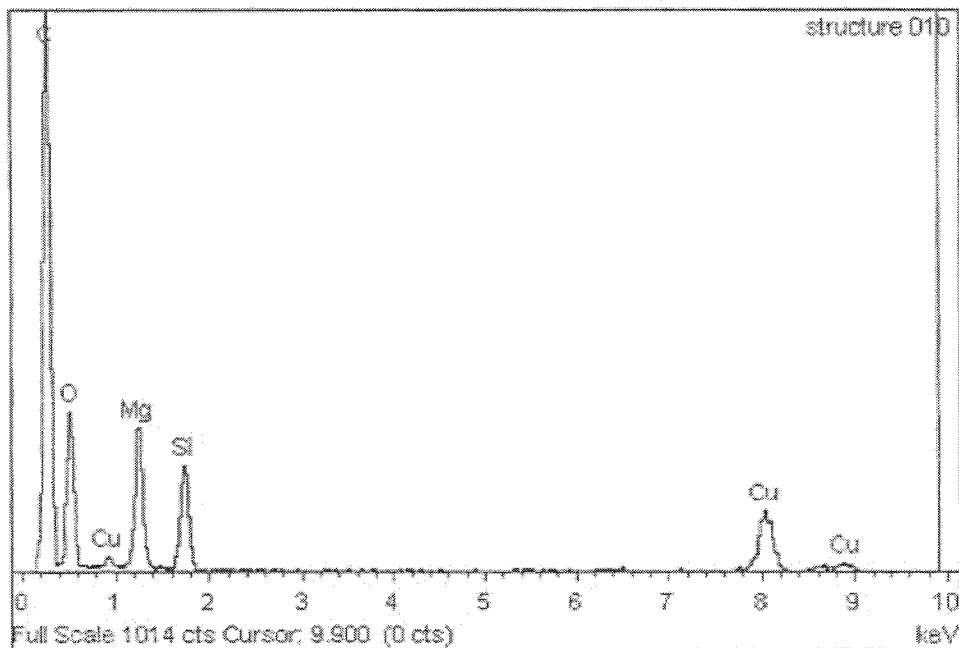
**TABLE 1**  
**Air Samples**

MVA #	Description	Duration (Min)	Pump Rate (lpm)	Air Volume (L)
R1605	Before	60	5	300
R1606	During	16	5	*
R1607	During	16	2	16
R1608	Blank	0	0	0
R1609	Blank	0	0	0

\*Pump failed



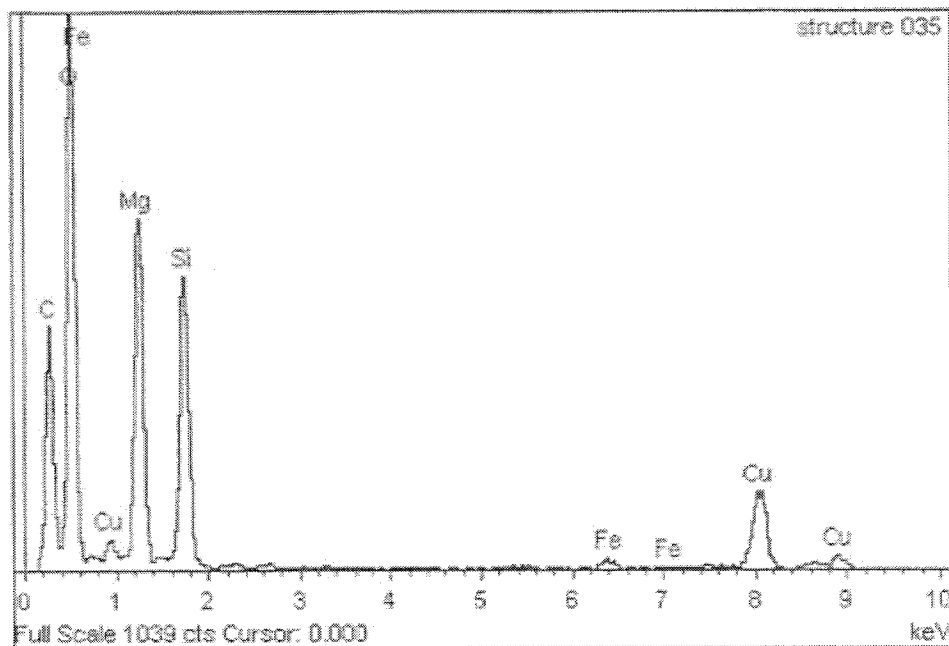
**Figure 1.** Transmission electron microscope image of chrysotile asbestos bundle (center) found in an air sample collected during disturbing Monokote fireproofing debris. There is no evidence of a gypsum coating or the "corn-dog" condition.



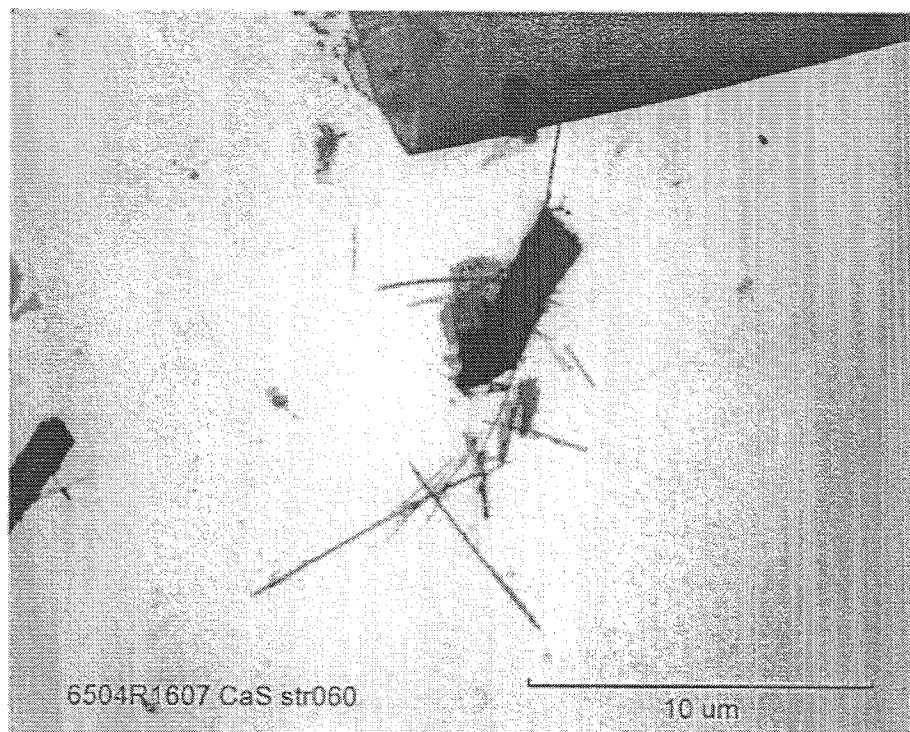
**Figure 2.** X-ray spectrum from chrysotile asbestos bundle shown in Figure 1. The magnesium and silicon are typical of chrysotile. The copper peaks are from the TEM system. No calcium or sulfur peaks indicative of gypsum are present.



**Figure 3.** Transmission electron microscope image of chrysotile asbestos bundle (center) found in an air sample collected during disturbing Monokote fireproofing debris. There is no evidence of a gypsum coating or the "corn-dog" condition.

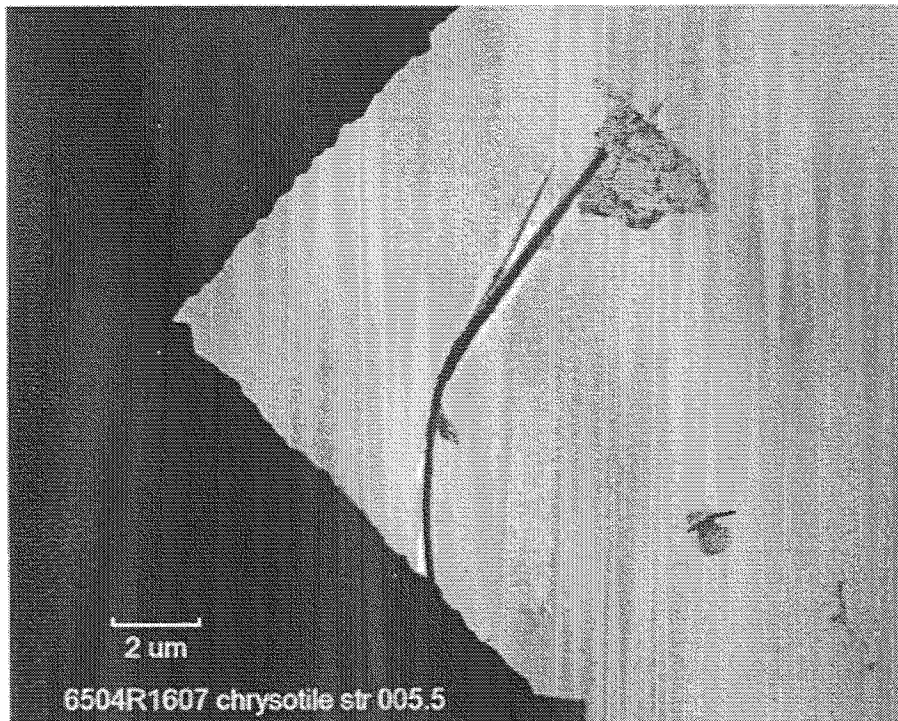


**Figure 4.** X-ray spectrum from chrysotile asbestos bundle shown in Figure 3. The magnesium and silicon are typical of chrysotile. The copper peaks are from the TEM system. No calcium or sulfur peaks indicative of gypsum are present.

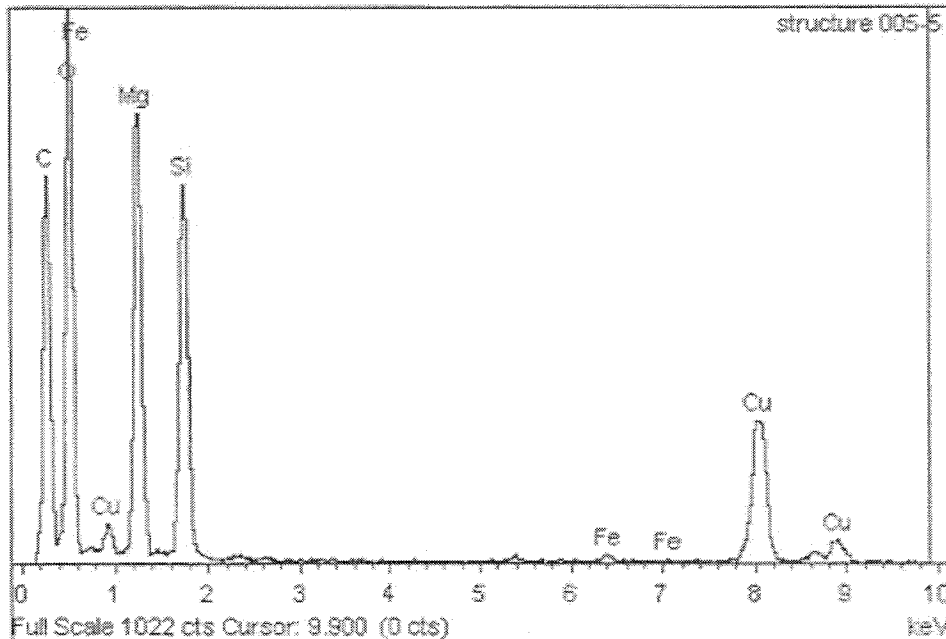


**Figure 5.** Transmission electron microscope image of a matrix of gypsum particle (larger dark elongated particle in the middle of the image, vermiculite (a thin plate that appears to be lying under the gypsum particle) and uncoated chrysotile asbestos fibers.

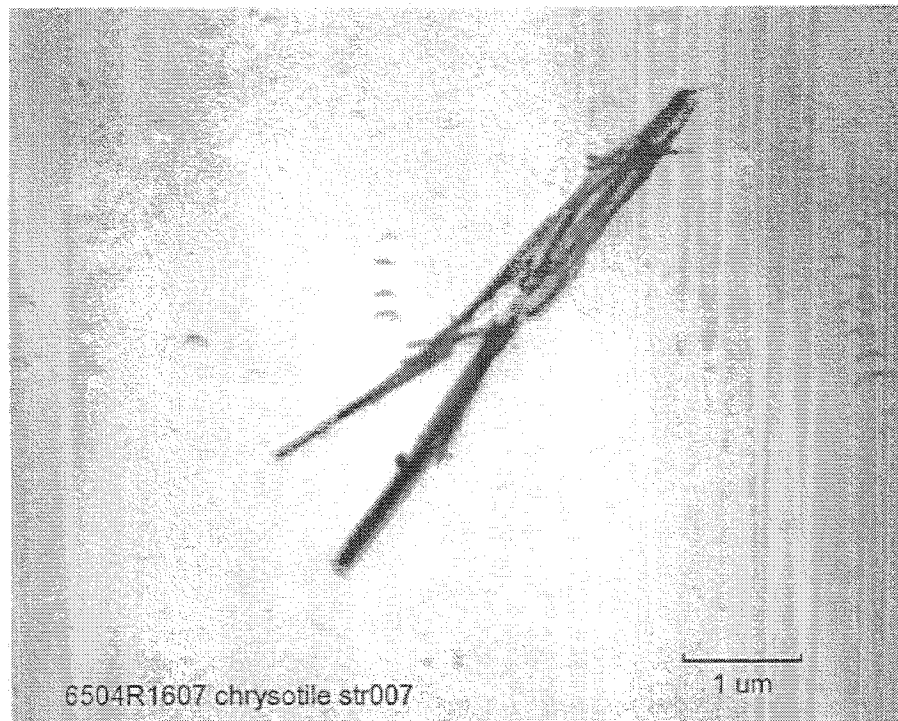




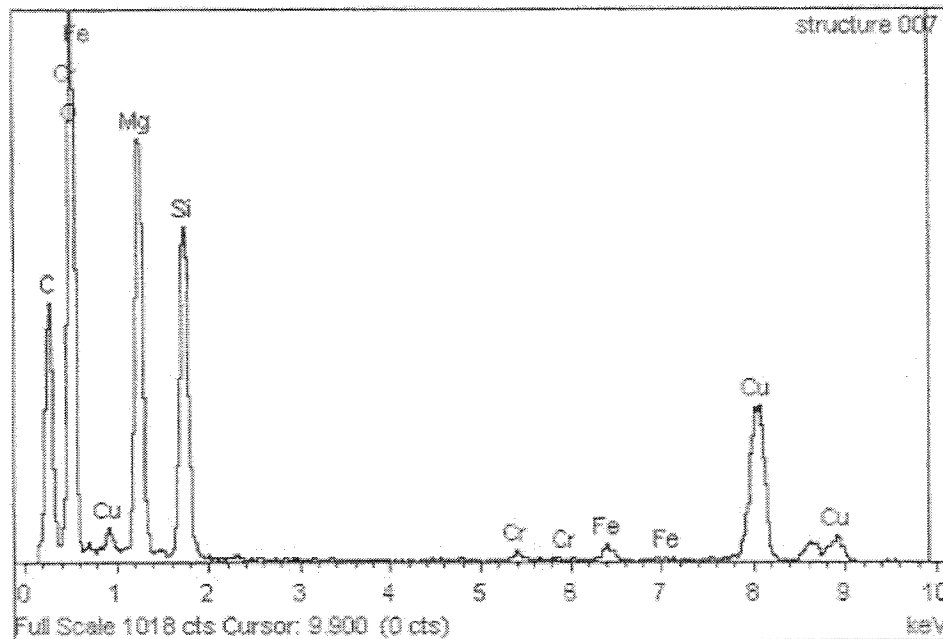
**Figure 6.** Transmission electron microscope image of chrysotile asbestos bundle (center) found in an air sample collected during disturbing Monokote fireproofing debris. There is no evidence of a gypsum coating or the "corn-dog" condition. A piece of vermiculite is seen at the top of the chrysotile fiber. There is no way to know whether the vermiculite particle and the chrysotile bundle were associated in the air or one landed on top of the other on the filter and therefore were individual particles in the air.



**Figure 7.** X-ray spectrum from chrysotile asbestos bundle shown in Figure 6. The magnesium and silicon are typical of chrysotile. The copper peaks are from the TEM system. No calcium or sulfur peaks indicative of gypsum are present.



**Figure 8.** Transmission electron microscope image of chrysotile asbestos bundle (center) found in an air sample collected during disturbing Monokote fireproofing debris. There is no evidence of a gypsum coating or the "corn-dog" condition.



**Figure 9.** X-ray spectrum from chrysotile asbestos bundle shown in Figure 8. The magnesium and silicon are typical of chrysotile. The copper peaks are from the TEM system. No calcium or sulfur peaks indicative of gypsum are present.

## Appendix A

# A Close Examination of Asbestos-Containing Debris

By James R. Millette, Ph.D., William Ewing, CIH  
and Richard S. Brown, M.S.

**F**or a variety of reasons asbestos-containing fireproofing may release material pieces in a range of sizes.

Small pieces (less than a cubic centimeter) of asbestos-containing material are often seen by the unaided eye lying on ceiling tiles installed below spray-applied fireproofing. During routine maintenance activities or in other situations when the tiles are moved, these particles may fall on the floor. There may be a tendency to dismiss these small particles as an insignificant source of asbestos contamination. Under a magnifying glass (5x) asbestos fibers may appear to be completely encased in a binder (gypsum or clay) and, therefore, would not be considered available to be released into the environment.

From a fireproofing that had been on the undersiding of decking in a building for approximately 18 years, several small pieces of debris were collected on a metal sheet placed below the fireproofing. These pieces were placed in a 35mm film canister and sent to the laboratory for examination.

Examination by stereomicroscopy showed some fibrous material protruding from the pieces. By polarized light microscopy, the fibers were determined to be chrysotile. One of the pieces was chosen for further examination.

Examination was performed by scanning electron microscopy-energy dispersive spectroscopy (SEM-EDS). The SEM-EDS system consisted of a JEOL Model 820 with a Tracor Northern 5402 X-ray system. At a low magnification (15x) the particle appeared to be an open, airy aggregate covered in part by a binder material (*Figure 1*). At higher magnifications, chrysotile bundles and individual chrysotile fibers as confirmed by EDS were observed on the aggregate surface and protruding from the aggregate surface. *Figure 2* (arrow in *Figure 1*) shows a chrysotile bundle protruding from the surface, which at this low magnification appears to be completely

covered by binder material. However, at a higher magnification, (1,400x, *Figure 3*), it was found that while binder particles are intermixed with the chrysotile fibers, chrysotile can be observed throughout the bundle free from binder material. *Figure 4* is the EDS spectrum obtained from chrysotile fibers in *Figure 3* [Magnesium (Mg) and Silicon (Si)]. *Figure 5* (arrow "B" in *Figure 2*) shows gypsum particles at the base of the chrysotile bundle in *Figure 2*. *Figure 6* is the EDS spectrum obtained from a gypsum particle in *Figure 5* [Sulfur (S) and Calcium (Ca)]. Hundreds of fine, uncoated chrysotile fibers were observed on all the aggregate surfaces.

As an experiment to see how the fireproofing material would be affected by someone stepping on small pieces, a second aggregate was placed into a sealed zip-loc plastic bag and crushed by having a volunteer walk on the bag. A small section of the plastic bag that had aggregate material adhering to it was excised and prepared for SEM-EDS analysis.

Many chrysotile fibers were observed

among vermiculite and gypsum particles adhering to the inside surface of the bag. Higher magnification of the chrysotile fiber demonstrated that the fibers were essentially free of binder material.

It is clear from the micrographs shown here that asbestos fibers are not completely encased in binder when in the debris of at least one common type of fireproofing. Proper care needs to be taken when dealing with asbestos-containing material debris falling from fireproofing to avoid exposure to asbestos fibers. ■

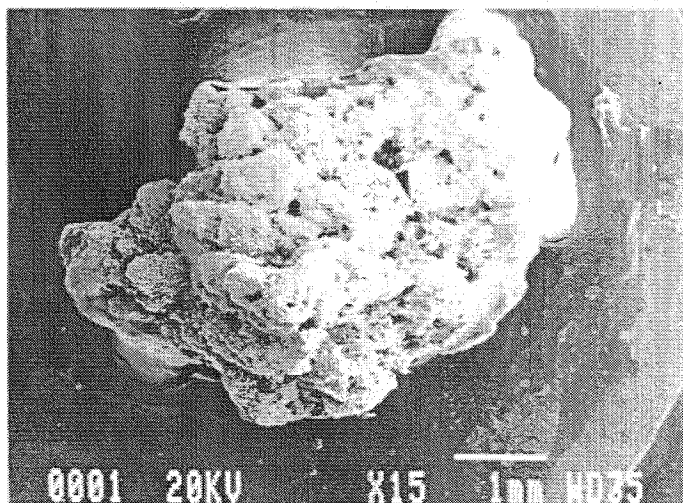
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*Figure 1. Low magnification SEM micrograph of fireproofing material released (Bar=1mm).*



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Figure 2. Higher magnification of chrysotile bundle indicated by arrow in Figure 1 (Bar=100µm).

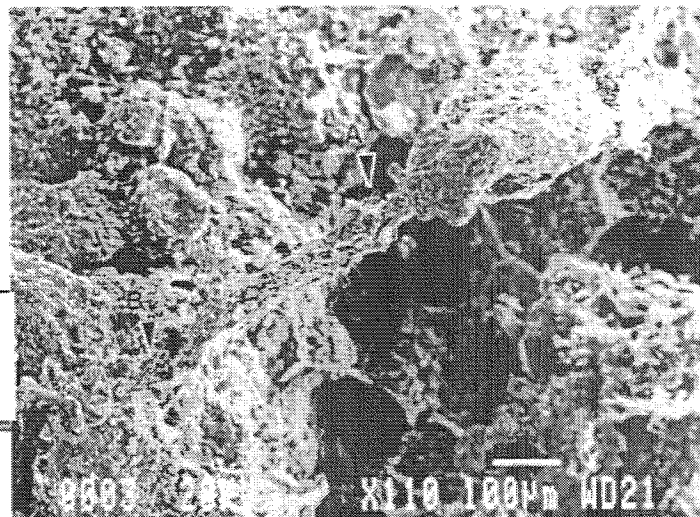


Figure 3. Higher magnification of area indicated by arrow "A" in Figure 2 (Bar=10µm).

Figure 4. X-ray Energy Dispersive Analysis Spectrum (EDS) of chrysotile indicated by arrow in Figure 3. Magnesium (Mg) and silicon (Si) are from the chrysotile fiber. Gold (Au) comes from the gold coating preparation of the sample for SEM analysis.

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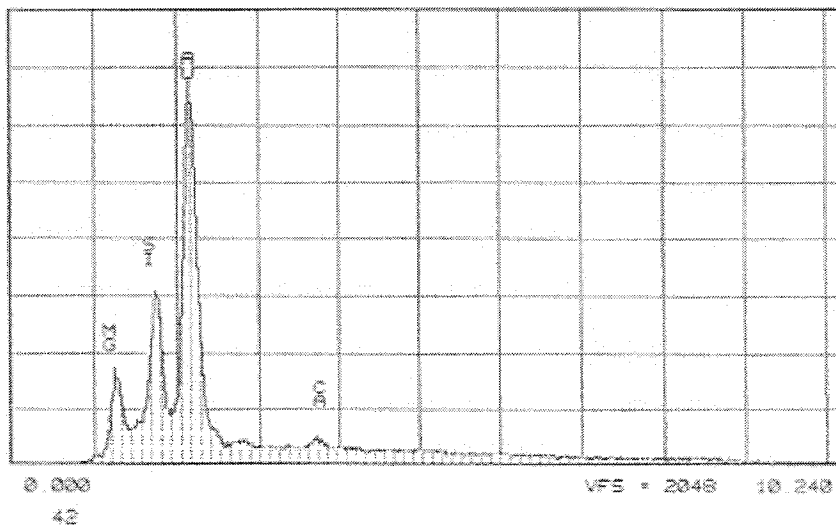


Figure 5. Gypsum particles among chrysotile fibers in area indicated by arrow "B" in Figure 2 (Bar=10µm).

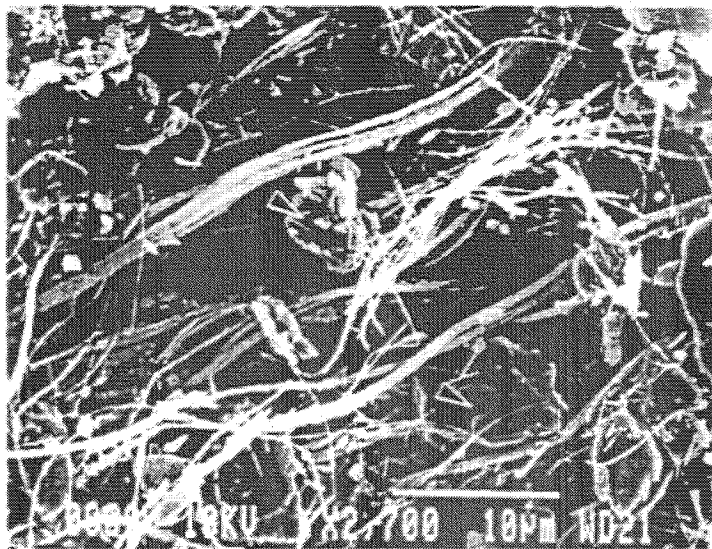


Figure 6. EDS of gypsum particles in Figure 5. Sulfur (S) and calcium (Ca) are from the gypsum particles. Mg and Si from nearby chrysotile. Gold (Au) from gold coating on specimen for SEM analysis.

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